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1. Sensitizing of Photographic Plates

Work has been initiated on the flocculation of the sensitizing dye caused by ammonia and on the use of staining baths without ammonia. Facilities have been assembled for the accurate sensitometry of red-sensitive plates. A number of conferences with manufacturers of photographic plates have been held in the matter of the researches recently carried on in the field of plate sensitizing. A number of samples of sensitizers have been tested, among which may be mentioned an approximation to dicyanin prepared by the chemical division of this Bureau. Two sets of these samples showed excellent sensitizing powers at great wave lengths.

2. Optical instruments

Optical instruments tested for the military services included 51 field glasses for the Signal Corps; 85 Galilean binoculars for the Shipping Board; 5 gunsights for the Army and Navy Ordnance Bureaus; numerous samples of optical glass tested for indices and dispersion for the Frankfort Arsenal, for the Signal Corps and for the Bureau of Aircraft Production. At the request of the War Industries Board a careful study and report was made on the degree of parallelism required for sextant mirrors, a matter having an important relation to the manufacture of such mirrors. At the request of the Ordnance Department of the Army a preliminary opinion was rendered on the effect of striae in rolled optical glass upon the utility of prisms for battery commanders' telescopes, and final conclusions will follow shortly after the completion of certain necessary experimental work. A device for the rapid testing of mil scales in binoculars has been developed during the past month and such scales are now being tested by the projection method. The Bureau has been consulted by the Italian and Australian government authorities in matters relating to optical glass manufacture.

3. Annealing of Optical Glass

The Bureau conducted a study of the annealing of optical glass submitted by the Keuffel & Esser Company, who are contractors for optical instruments for the Army and Navy, and deter-

mined by observations of the double refraction of the glass the proper temperature for removing the strain. From the measurements of the rate of bending of the glass at various temperatures, values of the relative viscosity were obtained. The time required to anneal any specified size of sample bears a definite relation to these values of relative viscosity. Tables were given showing the time required for annealing at any desired temperature in order that the stress remaining after this time be reduced to 0.1 or 0.01 of its original value. The time rate at which the glass can be cooled after annealing was carefully considered and data were given for these rates and for the maximum temperature at which a block of glass, of specified size, can be safely removed from the annealing oven.

4. Braun Tube Oscillograph

The Bureau has for some time endeavored to have manufactured by a commercial concern the Braun tube oscillograph, which is not now available commercially. Not being successful in this attempt, the Bureau is now undertaking to build two or three such oscillographs for use in radio work and for investigation of spark plugs.

5. Public Utilities Work

Circular number 72 entitled "The Scope and Application of the National Electrical Safety Code" has just been received from the press. The first draft of an Elevator Safety Code has been prepared and sent out for criticism, and work has been begun on the compilation of Marine Electrical Safety Rules.

6. Automobile Headlamp specifications

The Bureau has cooperated in laboratory and road tests of numerous headlamp devices. As a result specifications have been formulated covering allowable and required intensities of automobile headlamps. These specifications have been adopted by the Secretary of the State of New York as a basis for approval or disapproval of devices submitted in that state.

7. Engineering Instruments

Tests of engineering instruments recently conducted for the military services included special tests of 7 small high-pressure oxygen gages and numerous other pressure gages; four Biram anemometers; and relief discs for high-pressure oxygen valves. Information was given at the request of the Construction Division of the Army respecting the relative merits of a num-

ber of different thermostatic valves for steam heating, with copies of the test data. Information was given at the request of the Bureau of Yards and Docks of the Navy Department regarding the merits of a certain make of radiator return line valve; at the request of the Hardware and Metals Division of the Quartermaster Corps relative to the merits of certain carbon tetrachloride fire extinguishers; to the Emergency Fleet Corporation regarding taffrail logs; and to contractors for the Emergency Fleet Corporation regarding high-pressure gages suitable for certain inspection tests, and sources from which such gages could be obtained.

8. Airplane Wing Fabrics

A special study has been made of the relative merits of pasting and sewing of the fabric at the trailing edge. The linen and cotton cords used for lacing airplane fabrics to the ribs were investigated to determine their relative resistance to fatigue and abrasion. It was found that the cotton cords were materially better. Continued experiments intended to make complete the information regarding possible structures of airplane fabrics have not as yet resulted in any material improvement over the fabrics now being specified, as a result of the Bureau's researches, for wing covering purposes.

9. Uniform Fabrics

Several of the present fabrics embodying various combinations of raw stock have been submitted for determinations of relative wear resistance and comfort afforded the wearer. Such tests have never been carried out before and work of this character, if successful, should be of the greatest value in standardizing and stabilizing purchases of uniform materials. Samples of the English uniform fabrics are being analyzed in comparison with American and French products. Several interesting samples of German uniform fabrics have been received and analyzed. The use of paper in uniforms of prisoners and of personnel at base depots is noteworthy. A representative of the Bureau has just returned from an extensive trip of investigation in England and France, making available much information regarding the general situation in military textiles

10. Ship Workers' Clothing

The Emergency Fleet Corporation of the U.S. Shipping Board has requested the Bureau to investigate the properties of winter clothing of

men engaged in outside work on ship construction. A number of suits will be made available for tests and determinations will be carried out of the heat conductivity, permeability to wind, and such other tests as will determine definitely the relative serviceability of such materials. By this means it is hoped to develop a definite criterion by which proper clothing for these conditions can be selected.

11. Gas Engine Explosion Phenomena

Preliminary experiments have been performed on the explosion of gases by different types of discharge of high voltage and small energy, the object being to study ignition under conditions where temperature effects are small compared to the ionization produced.

12. Trench Oil Stoves

Eight oil stoves submitted by the Quartermaster Corps were examined and tested with a view to determining their suitability for use as trench heaters and as a basis for the preparation of specifications for such heaters.

13. Miscellaneous Heat and Thermometric Tests

Tests recently conducted by the Heat Division for the military services include the following: 30 airplane thermometers for the Bureau of Aircraft Production; 3 acetylene generators for the Field Medical Supply Depot; specific heat of samples of nichrome for the Bureau of Ordnance; fogging of airplane sights at low temperatures, for the Bureau of Aircraft Production.

14. Munitions Gage Testing

The net totals of munitions gages tested during the month of August are as follows: (a) number of lots received, 523; (b) total number of gages received, 5513; (c) number of thread gages, 1971; (d) number of profile gages, 676; (e) number of plain gages, 2866. The average length of time during which lots of gages were in the Bureau was less than four days. During the month 144 gages were salvaged to agree with the latest revised drawings.

15. Instruction Courses in Gage Work

The first class of instruction in the measurement and use of munitions limit gages has just been organized, with 14 members; the course to include lectures and laboratory work on the organization and routine of gage testing, the measurement of plain thread and profile gages, use of gages, salvage of gages, gage

drawings, specifications and tolerances. Of the 13 District Ordnance Offices 11 have sent a representative to this first class.

16. Screw Thread Standardization

About 2900 copies of a questionnaire calling for information on the standardization of screw threads were prepared and dispatched to tap and die makers for straight and pipe threads, gage makers, users and manufacturers of bolts, screws and nuts, and to a selected list of members of the Society of Automotive Engineers and of the American Society of Mechanical Engineers. This questionnaire relates to the work of the Commission created by Congress to establish standards for screw threads, headquarters for which are at the Bureau of Standards.

17. New Equipment for Thermal Expansion Investigations

Installation has been completed of equipment which makes possible securing accurate data upon thermal expansion of solids up to 1800° F (1000° C). On account of the effects of the high temperatures upon the materials investigated it was found necessary to use an entirely new method of support for the contact or position wires, by means of which the ends of the specimen are located in the measurements, to the end of eliminating the errors resulting from oxidation of the metals and the stiffness of the wires. Expansion tests are to be made on certain parts of the Liberty Motor and the recalescence point and transformation region of various steels are also under investigation. In this connection work is being done on the behavior of machine gun steels at high temperatures.

18. Airplane Power Plant Investigations

The staff and equipment for this investigation have been transferred to new quarters in the Northwest Building. After six months continuous operation, extensive revisions have been made in the altitude test chamber in which a Liberty 12 is now being run for the purpose of developing means for controlling automatically the behavior of a carburetor at varying altitudes. Plans are being made for the construction of two new altitude test chambers so arranged as to be adapted for use either singly or together, thus permitting of the doubling of the cooling and exhaust disposal capacity.

An Hispano Suiza 150 H.P. engine and a Gnome engine are being operated for investigating the performance of spark plugs, ignition

systems and of different grades of lubricating oils. At the request of the Inventions Board, an investigation has been carried on with respect to the effect of water injection on the performance of the Liberty Truck engine. A large number of brief reports are in preparation covering the work of the past year. Most of this series will be available by November first.

19. Liquid Forging Process

The Morris Engineering Company's process for liquid forging of light aluminum alloys was investigated in cooperation with the Naval Gun Factory. This process gives an alloy which should be very satisfactory for aeronautical engine pistons, cylinders, etc., appearing to be decidedly preferable to cast or die cast metal, on account of its superior strength and ductility and freedom from blow holes and other imperfections.

20. Metallographic Tests

Tests of this character recently included corroded aluminum tubes for Nitrate Section, Ordnance; defective parts from Browning machine gun; defective rifle receivers; malleable castings of widely varying cross-section for Artillery Ammunition Section, Ordnance; inferior shell steel; 3 exceptionally good gun steels; 12 gun forgings; study of ingot steel to determine suitable grain refinement; 12 samples "duriron" for Inspection Division of the Ordnance Department, including various treatments; 5 welded steel tires for Engineering Bureau of the Ordnance Department; defective brazed steel for Navy Aircraft; "Zelco" (a die casting Zn-Al alloy for magnetos) for Motors Division, Quartermaster Corps,-tests showed it to be unsuitable for the purpose intended; electrotyping materials; Johannsen gages; metallographic reports have also been prepared for the Ordnance Department on shell slugs, gun steel, a firing mechanism block and other parts of 155 mm howitzers.

21. Chemical Metallurgy

Preliminary work to ascertain the rate of volatilization of manganese and also to decide upon the best method of obtaining definite percentages of carbon is being carried out as an introduction to the systematic study of iron-carbon-manganese alloys. The results thus far obtained indicate that there will be about 5%

manganese loss during melting operations at atmospheric pressure. Experiments are now being conducted to ascertain the rate of loss in the vacuum furnace. A series of ingots ranging in carbon content from 0.1 to 1.5 percent by 0.1% steps, with manganese varying at the same rate within the same limits, is being prepared. A similar set of ingots without manganese addition is being prepared for comparison. When this series is completed, the ingots will be forged and made into test bars for physical examination. The object of this work is to ascertain the specific effects of manganese on the physical properties of carbon steels.

23. Foundry Sand Investigations

One thousand pounds of sand recovered by the Bureau from waste sand from the steel casting foundry of the Naval Gun Factory was tested at the above named plant to determine its fitness for re-use in sand mixtures for steel castings. Results were promising. The work is being continued. A study will be made of the fitness of the recovered sand from the above and a number of other foundries for the bottoms of open hearth steel melting furnaces.

23. Metallurgical Information

Information furnished by correspondence to various military branches included a report on the Bourcoud process of iron reduction; discussions on the Mitchell process of treating cast iron and steel; on New Era soft solder; on resistance of aluminum alloys to sea water corrosion; on the recarburization of spring steel; on corrosion of aluminum tubes; on copper clad steel; on tests of zinc bronze; on effect of heat treatment on galvanized steels; on the nomenclature of alloys; and on the comparative corrodibility of nonferrous alloys, etc., etc.

24. Strength of Woods

Preliminary experiments are being made upon the resistance of wood to impact loads. Tests made with a 60-lb. hammer rupturing the specimen in one blow are giving valuable data upon which to base future work. Careful studies have been made of processed cypress. It appears that yellow or a white cypress is superior to the black type and if the white (or yellow) can be obtained in sufficiently large quantities and rapidly seasoned, it may be of value as an additional species to be utilized in airplane construction.

A product designed to serve the same purposes as Bakelite products, composed of cotton linters, wood, silk, or other fibres, bound in a patented carbohydrate preparation, has been tested. It was found to have a low strength compared with most species of wood when compared on a weight basis.

25. Design of Metal Tables

At the request of the Field Medical Supply Depot, about 50 metal bedside tables for field hospital use were examined and tested. It is interesting to note that most of them were seriously defective in design, a fact confirmed by strength tests; moreover, the higher priced tables did not in most cases show either better design, material, or workmanship than those of lower price.

Respectfully,

S. W. STRATTON

Director